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Anne Odile Peschel

Aarhus University

Stephan Zielke

Wuppertal University

Joachim Scholderer

Aarhus University, University of Zurich

Abstract. The internal reference price is the decisive standard against which observed prices are compared to evaluate whether a product offering is a good deal or not. If no reference price has been established for a product category, such as for product innovations, is it uncertain against which standard the price can be compared. Despite extensive research on the use of reference prices, little is known how an internal reference price is constructed for an unfamiliar product category. We conduct two experiments to support our two suggested mechanisms. Reference prices for an unfamiliar product category can either be constructed through repeated exposure to incidental price information or through transfer of price information from a familiar, similar product category to an unfamiliar product category, but only if the product value and price are correlated; a condition often not considered in product innovation testing.

Keywords: Behavioural pricing, internal reference price, product innovation

Track: Pricing

1. Background

During a shopping trip, consumers have to conduct a sequence of evaluation and choice tasks. To evaluate whether a product offering is a good deal or not, consumers have to compare the alternative's price to a reference price. In order to understand and predict evaluative outcomes better, it is essential to understand how this reference price is constructed. In the behavioural pricing literature it is assumed, that consumers develop an internal reference price, which consists of a range of acceptable prices that becomes more distinct with experience (Cheng & Monroe, 2013). Despite considerable amount of research on the use of reference prices, little is known about how such a reference price is constructed for an *unfamiliar product*. The fast moving consumer goods market, which is characterized by a range of new products introduced into the market every year and low involvement decision processes, constitutes an interesting setting to study the learning process of an internal reference price based on incidental price information. In particular, product testing of innovations in which consumers are asked about their willingness to pay for products for which they have no reference, are common practice and deserve closer attention. We assume two possible mechanisms of how a reference price can be constructed. The first one relies on an implicit learning mechanism of incidental price information (Frensch & Rünger, 2003). This is comparable to a situation of repeated exposure to an unfamiliar product category, for example through advertisements or instore. The other mechanism we assume is through transfer of price information between similar product categories. Assuming categorization as one of the basic principles for how we structure our environment (Rosch, 1978), it is likely that if no prior reference price information is available for an unfamiliar product category, price information for a similar, familiar product category is used as a proxy for constructing a plausible reference price for this unfamiliar product category. We conduct two experiments that confirm both mechanisms, but only if the combined product attribute value and the price follow a strict regularity, a condition which is not always ensured in preference elicitation methods.

2. Theory and hypotheses

We assume that a reference price can be constructed through implicit learning of incidental price information. The internal reference price is assumed to be constantly updated internal standard, according to adaptation-level theory (Helson, 1964). This means that new price information is evaluated to be within or outside the acceptable boundaries and – if within or not too far out - integrated into this range. This process results in a range of prices which is constantly adapted to the prices encountered in the environment A range of studies found support for this automatic updating and evaluation process of the internal reference price for a familiar product category (Adaval & Monroe, 2002; Chandrashekaran & Grewal, 2003; Yadav & Seiders, 1998). We assume the same process takes place for an unfamiliar product category:

H1: Repeated exposure of higher observed price information for a an unfamiliar product results in higher reference prices and vice versa.

Prospect theory suggests, that, due to loss aversion, at equal distance to the reference price higher prices are perceived to be closer to the standard than prices below the standard (Kahneman & Tversky, 1979). This suggests that reference prices should be updated more strongly in direction of gains than in direction of losses. These effects have been observed by a range of other studies reference prices (e.g. Chandrashekaran & Grewal, 2006) or expected prices (e.g. Kopalle & Lindsey-Mullikin, 2003). We therefore hypothesize:

H2: Lower observed prices lead to a stronger downward adjustment of reference prices than higher observed prices lead to an upward adjustment

The other mechanism that we assume is the transfer of price information from a familiar, similar category to an unfamiliar category, based on the basic principle of categorization (Rosch, 1978). New encountered objects and prototypes are categorized based on similarity features to the closest resembling category and its subordinates. This means that if an unfamiliar product category is encountered it will be evaluated on the features of the most similar a familiar category. A few studies investigated the effect of price information in one product category on willingness to pay in another product category (e.g. Adaval & Monroe, 2002; Nunes & Boatwright, 2004). These results suggest that upon encountering an unfamiliar product category, the reference price for a similar product category will serve as a comparison standard. We hypothesize therefore:

H3: Higher prices in a familiar category will lead to higher reference prices in a related unfamiliar product category

As mentioned before, we are interested in the constructing of the internal standard for price evaluations, because the standard selection is the key in determining outcomes of judgment and decision tasks (Mussweiler, 2003). Most studies found in the area of reference price updating however deal with willingness to pay estimates, which might not reflect actual retrieval of an internal reference price. The usually short lived effect of external price information on willingness-to-pay can be explained by numeric information in working memory wich might be used as a standard if the reference price is not available or too effortful to retrieve (Nunes & Bowatwright, 2004; Adaval & Wyer, 2011). It could also be that low product involvement or experience might render the reference price not reliable (e.g. Yadav & Seiders, 1998) and it might therefore not be used as standard in reference price judgments. These studies suggest that if no reference has been learned for a category or if the reference price is not perceived as a reliable comparison standard, it might not be retrieved in a judgments process. However, if the internal reference price is used as a comparison standard, the observed price level should influence the perceived price level indirectly. This is why we hypothesize:

H4: The internal reference price serves as a mediator between the observed price level and the price level judgment.

3. Experimental design

To test the presented hypotheses we need a complex experimental design that can accommodate both mechanisms. We conducted two experiments using the same stimuli and similar procedures. To study both suggested mechanisms of how an internal reference price is constructed for an unfamiliar product category, we need two similar product categories which are unfamiliar to the respondents. We therefore use stylised products which varied slightly in shape and colour. To test the first reference price formation mechanism the reference price should be learned implicitly through repeated exposure of incidental price information in the first exposed Category 1. To test H1, reference prices must be assessed prior and post the experimental task. To address H2, we used a two factor between subjects design displaying either low or high prices for Category 1. To test the second suggested reference price formation mechanism, we measure the reference price for a similar, unfamiliar Category 2 after exposure to price information in Category 1 (H3).

3.1. Stimuli

The product stimuli used were rectangular shapes that varied in color and outline. Category 1 were grey rectangles with sharp edges and Category 2 were purple rectangles with rounded edges. Participants were told that same shape objects should be considered to be of the same product category. These categories should resemble categories that could be found in the

same supermarket. The products carried up to 6 colored symbols which resembled product attributes. Participants were told that these attributes varied in hedonic, but not monetary value. This can be thought of a situation in which all flavour variants of a product have the same price, even though our favourite flavour is of more hedonic value to us than all the other variants. All products were displayed alongside a price tag. The high price range was constructed non-overlapping around a mean of 30 DKK; the low price range similarly around a mean of 10 DKK.

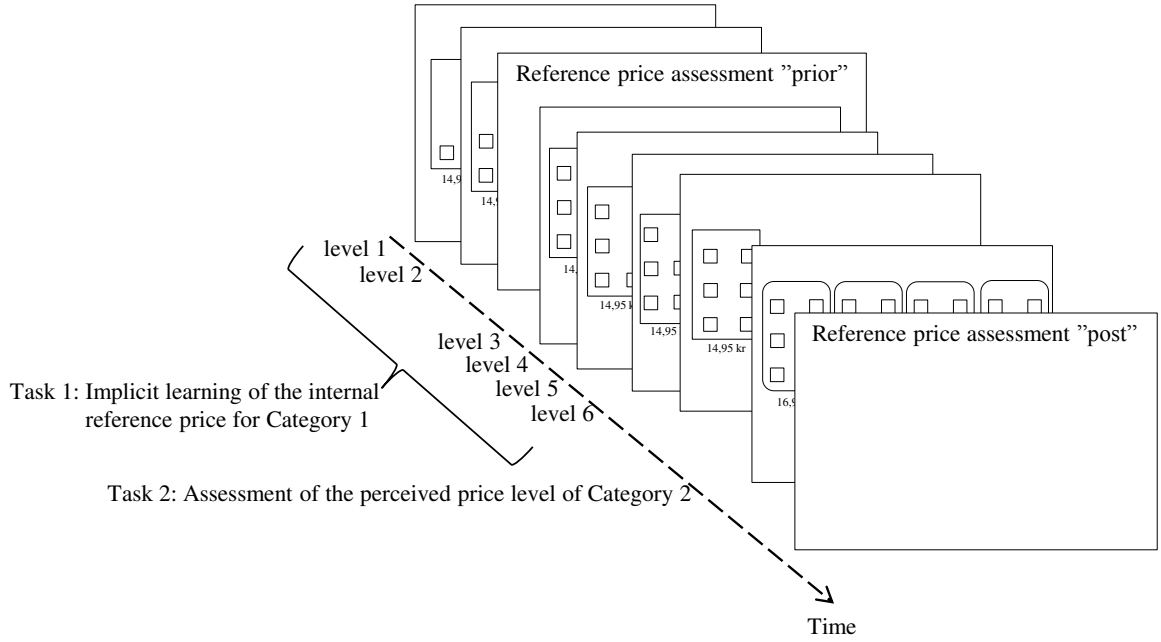
3.2. Reference price assessment and perceived price level

Reference price ranges were assessed using a procedure adapted from Chandrashekaran and Grewal (2003). Participants had to indicate the typical price, the highest price they would be willing to pay and the lowest price they had seen for each product category using three visual number lines ranging from 0 to 40 DKK. An index of these items was used as reference price. The visual number line format was used instead of the traditional open ended numeric format, because it should be more compatible with the natural representation of the internal reference price range (Cheng & Monroe, 2013). Perceived price level in Category 2 served as dependent variable for testing H4. Participants were asked to rate expensiveness and price level on 7-point scales, comparable to previous studies (Ofir, Raghubir, Brosh, Monroe, & Heiman, 2008).

3.3. Procedure

Upon arrival to the university's laboratory, participants were randomly assigned to a computer work station and instructed to follow the instruction on the screen as depicted in Figure 1. In the beginning of the experiment, participants were presented with the products from the two categories and instructed to think of them as products that can be bought in a supermarket. Thereupon followed the *learning task 1* in which participants were exposed to 2x16 high or low price-product combinations (level 1 & 2, Figure 1) to implicitly establish a reference price for *Category 1*. Reference prices were assessed subsequently ("prior" reference price assessment, Figure 1). Next, participants were exposed to 4x16 high or low price-product combinations (levels 3 to 6, Figure 1). To ensure incidental price exposure, participants were preoccupied with a task, indicating the hedonic value of the product attributes. In the following *task 2*, participants were presented with a product assortment from *Category 2* at a price range around 20DKK. The products carried different attribute combinations but were equal in value. Perceived price level was assessed for the overall assortment. Subsequently, participants had to indicate their reference price for both product categories, which we call "post" reference price assessment.

Figure 1. Experimental procedure of Experiment 1A and 2



4. Experiment 1

We recruited 70 paid volunteers from the university's research laboratory. The mean age was 24.5 (SD = 4.22) and females were slightly overrepresented (64.3 %). The price level judgments from Task 2 showed a sufficient reliability (Cronbach's α = .90).

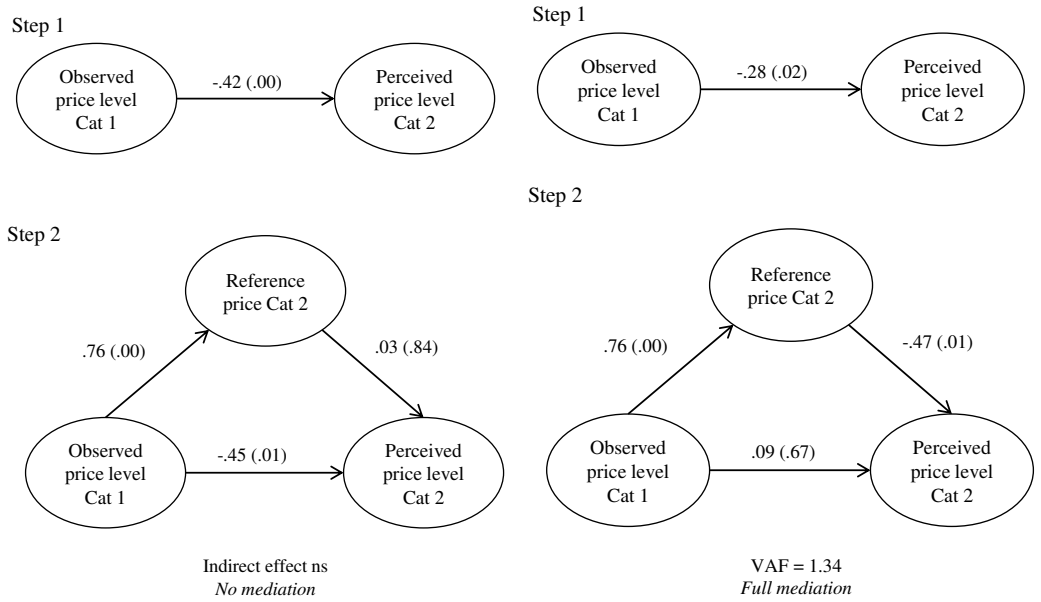
4.1. Reference prices

The elicited reference prices for Category 1 differed significantly between the high and the low price condition for Category 1 (Cat 1 prior: M_H = 23.44 vs. M_L = 12.73, $F_{(1,68)}$ = 89.58, p<.0001, Cat 1 post: M_H = 26.24 vs. M_L = 10.45, $F_{(1,69)}$ = 311.89, p<.0001), thus supporting H1. The reference prices in the low price condition were closer to the mean of 10DKK than the reference prices in the high price condition to the mean of 30DKKconfirming asymmetric updating effects as suggested by H2. Category 2 reference prices showed a carryover effect from prices displayed in Category 1 (Cat 2 prior: M_H = 22.63 vs. M_L = 12.91, $F_{(1,69)}$ = 92.78, p<.0001, Cat 2 post: M_H = 22.24 vs. M_L = 12.6, $F_{(1,69)}$ = 80.47, p<.0001), confirming H3.

4.2. Perceived price level

We use partial least squares structural equation modeling (PLS-SEM) to determine whether the elicited reference price serves as a mediator between the observed price level of Category 1 and the price level judgment of Category 2 (Baron & Kenny, 1986; Hair, Hult, Ringle, & Sarstedt, 2013). Using bootstrapping as suggested by Preacher and Hayes (2004), we can determine the strength of the direct effect of the observed price level in Category 1 as well as the strength of the indirect effect of the reference price as mediator on price level judgments. This allows us determine the variance accounted for (VAF) by the indirect effect. As can be seen from Figure 2, in a first step, we regressed the perceived price level in Category 2 on the price level in Category 1 and found a significant negative influence. In a second step, we include the reference price from Category 2 in the model and find a significant positive effect of the observed price level in Category 1 on the reference price in Category 2, however no significant effect of the elicited reference price on the price level judgment in Category 2. Due to the non-significance of the path from the elicited reference price to the price level judgment, we cannot confirm H4.

Figure 2. Mediation analysis of Experiment 1 (left panel) and 2 (right panel)



Note: Numbers on arrows depict path coefficients with p-values in brackets.

5. Experiment 2

We used the same stimuli and procedure as for experiment 1, except that we imposed a correlation between the combined hedonic attribute value and the price. For each attribute value added, the price increased with approximately 2 DKK. We recruited 63 paid volunteers, with a mean age of 38.95 (SD = 16.01) years, evenly distributed across gender. The two price level judgments were again reliable in describing the perceived price level (Cronbach's $\alpha = .88$).

5.1. Reference prices

Again, the reference prices for Category 1 show a clear bias towards the encountered prices (Cat 1 prior: $M_H = 20.47$ vs. $M_L = 10.42$, $F_{(1,62)} = 78.65$, $p<.0001$, Cat 1 post: $M_H = 23.84$ vs. $M_L = 10.45$, $F_{(1,62)} = 44.91$, $p<.0001$), thus supporting H1. Also the reference prices were closer to the mean in the low price condition than in the high price condition, thus supporting H2. Category 2 reference prices were significantly higher in the high price condition than in the low price condition (Cat 2 prior: $M_H = 21.47$ vs. $M_L = 12.90$, $F_{(1,62)} = 83.91$, $p<.0001$, Cat 1 post: $M_H = 21.73$ vs. $M_L = 14.94$, $F_{(1,62)} = 37.32$, $p<.0001$), supporting H3.

5.2. Perceived price level

We use the same mediation analysis approach as in Experiment 1. In a first step, we again observe a significant negative effect of price level in Category 1 on the perceived price level of Category 2, as can be seen in Figure 3. Both paths to and from the reference price for Category 2 were significant, indicating a positive effect of price level in Category 1 on the reference price for Category 2 and a negative effect of the reference price in Category 2 on the price level judgment in Category 2. The bootstrapping procedure resulted in a standard error of .14, which resulted in a significant t-value[1] of -2.55 for the indirect effect. The direct effect of the price level in Category 1 on the perceived price level in Category 2, became

[1] Obtained by dividing the product of the path coefficients to and from the mediator by the standard error (Hair, et al., 2013).

insignificant and positive after including the mediator. This sign change resulted in a VAF >1, which suggests full mediation of the effect of price level in Category 1 on the perceived price level in Category by the reference price for Category 2 and thereby confirms H4.

6. Overall discussion and conclusion

In all judgment or evaluation tasks, we compare a target to a standard. Understanding how the relevant standard is chosen and how it is constructed is vital to predict evaluative outcomes. The internal reference price as a standard relevant in all economic choices was therefore subject of this research project. Reference price research has been mainly concerned with how malleable the construct of an internal reference price or reference point is. We could find support for two mechanisms to construct an internal reference for an unfamiliar product category. The internal reference price can either be learned through repeated exposure to incidental price information. The other mechanisms suggest that the internal reference price can be constructed based on the transfer of price information from a familiar, similar product category to an unfamiliar product category. Both mechanisms work however only if price and the combined hedonic attribute value are closely linked to each other. These results suggest that in studies where updating of an internal reference price towards extreme or irrelevant prices was found, it might have been a task-induced reference price that was elicited and not the individual's *true* reference price. Lack of involvement with the task or lack of accessibility of the construct would render it likely that numeric information which was previously obtained and not actively inhibited was used as a surrogate reference price that would satisfy the task demands at the lowest cognitive effort possible.

Our results showed that a reference price for an unfamiliar product category could be learned implicitly, given that price and value information were congruent. Future research should investigate how sustainable the implicitly learned reference price is. If the results turn out to be as short lived as anchoring results, then the implicit learning mechanism might not be sufficient and the internal reference price range is constructed more complex than previously assumed. From a practitioners point of view, when testing the acceptance of and willingness to pay for product innovations, it important to keep in mind that depending on the degree of innovation, participants cannot estimate a reliable willingness to pay statement, because they have no standard to compare the product to. When using choice experiments or experimental auctions with suggested prices, it is essential to correlate the prices with the combined attribute values accordingly, to facilitate learning of an internal reference price, which should serve as a more reliable source for willingness to pay estimates. The two identified mechanisms also provide different opportunities for influencing the reference price formation of new products (e.g. through product categories presented close to the new innovative category in a store, etc.).

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